

## Text Lecture 1a - Introduction

Welcome to this course, "Introduction to Aeronautical Engineering", the course in which you will understand the basic principles of how we can fly.

You might wonder 'why do we need to know these basic principles?' because the aircraft is already invented, isn't it?

But to make sure that we can continue flying we need a lot of people who understand how you can fly, because it is not a given that we can keep on flying, as you will see at the end of the first module.

And flying is important, aviation plays an ever increasing role in our society.

I've got a few figures of the year 2007 from Oxford economics which show the importance of aviation for society.

For instance there are 7 billion people on the Earth. How many do you think would fly annually? And if you fly twice, we count you twice.

So the question is basically how many passengers do fly annually?

Well I think the number is quite astonishing, compared with 7 billion people on the Earth, 2.5 billion fly annually, and 50 million tonnes of freight is also transported through the air annually, often in the same aircraft by the way.

This also creates a lot of jobs, it is important for also the employment. For instance if you look at the aviation sector alone you have 15 million jobs, and then I do not count associated sectors which would no doubt be smaller, like tourism, where there are 16 million jobs alone.

Also the total turnover of the aviation sector, so all the industry that is involved in flying, is an astonishing 1 trillion US dollars.

And if it is not enough, if later you ever need to justify the investment in innovation in aerospace, just show the growth, because it is still ongoing and if you look from 2007 to what we expect in 2026 (including the occasional crisis) we expect in those years a growth of 145%.

And we see that things like the SARS crisis, or the 9-11, or the current economic crisis they happen only to delay the growth for one or two years, but then it really picks up again, and especially in Asia and Africa a lot of growth is expected in aviation.

So it plays an important role for the moving of passengers, I also mentioned the freight, 50 million tonnes of freight, I did not relate this to any numbers.

If you look at the actual weight, obviously through the air you transport light cargo.

But it turns out to be also high value cargo, if you look at the fraction of the value of goods which are transported over the Earth, then over one third is transported through the air.

So aviation is important, but to understand the discipline you also wonder 'so what is it really, what is the discipline of aeronautical engineering?'

Well it turns out it is not just one discipline, it is actually a whole group of disciplines.

If we would look at an aircraft only from one discipline, it would look very different.

You see here an example, for instance on the right side there is the aircraft design optimised from the perspective of the propulsion group.

Underneath we see the stress group, who would like beams, clear and easy to calculate.

The weight group would like to see other materials, the wing group would focus mainly on the wing and think 'why is the aircraft not a flying wing?', aerodynamically speaking not a very bad idea,

and for each group you see if they optimise the aircraft from their own perspective it would look very differently.

And the art of aeronautical engineering is therefore how to combine all these disciplines into one design, and this means to understand how aircraft fly you need to understand the basic principles of many subdisciplines.

And this also shows why the course is set up as it is. So we start off with, in the centre basically, by looking at aircraft design and exploring all the different angles and looking at the different disciplines, in the introduction module.

Then, after the introduction module, we will look closer at two specific topics, one aerodynamics and the second flight performance, how the goals of the customer are achieved with aircraft design.

So we start of broad, we focus on aerodynamics and then we end with how this comes together again in flight performance.

For this course we have different tutors, the first module (so the overview, the introduction, looking at all the basic principles of all the disciplines) are given by Jos Sinke and me,

the second module is given by Nando Timmer (an aerodynamics expert) assisted by Hester Bijl (Professor in aerodynamics and the dean of our faculty)

and the third module is given by Mark Voskuil, an expert from our flight performance group.

We hope that after this course you will be able, with a minimal amount of data (what I always call the 'wikipedia data') to do your own calculations on aircraft and perhaps even think of your future aircraft design which will help the world, maintaining aviation.